

# Down You Go, H<sub>2</sub>O!

## TEACHER SECTION

**Grade Level:** 5-8

**Subject(s):**

Physical Science

**Prep Time:**

10 minutes

**Duration:**

45 minutes

**Materials Category:**

Classroom

### Objective

To observe temperature differences in a greenhouse model

### National Education Standards Science

*Science as inquiry*

- Abilities necessary to do scientific inquiry

*Physical Science*

- Motions and forces

### Pre-lesson Instructions

- Divide the class in groups of three or four students.
- Clear a space where drop tests can be conducted. This experiment could be conducted outside to prevent messy results.
- Since students will be using water, have a mop, sponges or paper towels available to clean up any spills.

### Background Information

Earth-orbiting spacecraft experience a condition described as apparent weightlessness. The spacecraft is in a state of free fall as it orbits. If the spacecraft has astronauts on board, the astronauts are able to move with ease because they too, are in a state of free fall. In other words, everything in their immediate world is falling together. This creates the weightless condition. The crew and contents of the spacecraft seemingly float through the air.

On Earth, momentary weightlessness can be achieved in a number of ways. Some amusement parks achieve a second or two of weightlessness in certain wild, high-tech rides. NASA achieves about 30 seconds of weightlessness with a special airplane fondly termed the "Weightless Wonder." High above Earth, the plane begins a long arc-like dive downward at a speed equal to the acceleration of a falling object. After 30 seconds, the plane pulls out of the dive and climbs back to the high altitude to begin another weightless cycle.

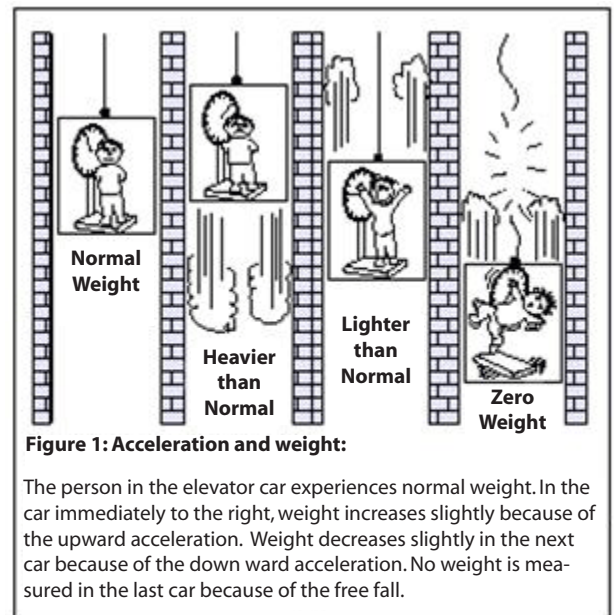
A falling cup, for a moment, demonstrates weightlessness. When the cup is stationary, water freely pours out of a hole in the side of the cup. If the cup falls, the water remains inside the cup for the entire fall. Even though the water remains inside, it is still attracted to Earth by gravity and ends up splashing out of the cup when it lands.

The demonstration works best when students are asked to predict what will happen when the cup is dropped. Will the water continue to pour out the hole as the cup falls? If your school has videotape equipment, you may wish to videotape the demonstration and then use the slow motion on the playback machine to replay the action.



### MATERIALS (per group)

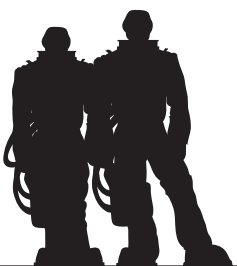
- Styrofoam® drinking cup
- Catch basin (large pail or waste basket)
- Water
- Chair or stepladder
- Towels
- Toy astronaut or any plastic figure
- Plastic jar
- Video camera and VCR (optional)



**Figure 1: Acceleration and weight:**

The person in the elevator car experiences normal weight. In the car immediately to the right, weight increases slightly because of the upward acceleration. Weight decreases slightly in the next car because of the downward acceleration. No weight is measured in the last car because of the free fall.

RETURN TO FLIGHT





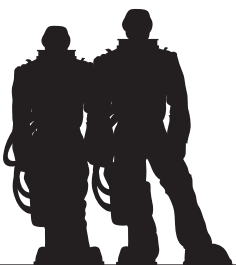
### Guidelines

1. Perform the following demonstration for the class.
  - Stand on a ladder and drop a toy astronaut or any plastic figure. It falls to the floor.
  - Next, drop a plastic jar, and it also falls to the floor.
  - Ask the class, "If I drop the astronaut INTO the jar at the same moment that I drop the jar."
  - Will the astronaut hit the bottom of the jar?"
  - Allow students to respond.
  - Demonstrate the fall with the figure and the plastic jar.
  - The astronaut does not hit bottom until the jar hits the floor. Explain that the figure is in free fall.
2. Discuss the situations where the students might have experienced brief encounters of free fall. Examples were given in the Background Information (roller coaster, elevator, etc.). Discuss why NASA simulates microgravity.
3. Distribute the Student Pages. Read the Background Information aloud, excluding the answer section in the third paragraph.
4. Divide the class into groups for the experiment. Explain that they will attempt to create weightlessness by using free fall, and they will observe how water is affected.
5. Allow the groups to repeat the experiment several times.

### Discussion / Wrap-up

- Have each group share their observations with the class.
- Explain and review the Background Information.

RETURN TO FLIGHT



*Styrofoam is a registered trademark of The Dow Chemical Co., Ltd. USA*





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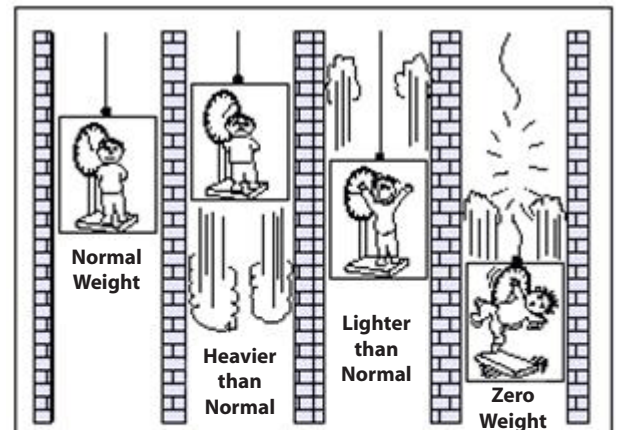
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### Procedure

1. Using a pencil, punch a small hole in the side of the Styrofoam® cup. Be sure the hole is near the bottom of the cup.
2. Place your thumb over the hole and fill the cup about half full of water.
3. Answer Question 1 on the Free Fall Worksheet.
4. Remove your thumb from the hole. Was your prediction correct?
5. Place your thumb over the hole and refill the cup.
6. Answer Question 2 on the Free Fall Worksheet.
7. Hold the cup up as high as you can (with your thumb still covering the hole) directly over the catch basin.
8. Drop the cup into the catch basin. Carefully watch the hole to see if your predictions for Question 2 were correct.
9. Answer the remaining questions on the Free Fall Worksheet.

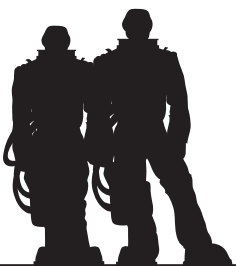
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# RETURN TO FLIGHT

Group Members: \_\_\_\_\_

## Free Fall Worksheet

1. Predict what will happen if you remove your thumb from the hole in the cup. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
2. Predict what will happen if you drop the cup with water inside.  
 Explain your answer. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
3. Were your predictions correct? \_\_\_\_\_
4. What happened when you dropped the cup? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
5. Would water flow out of the hole into the cup if it were on board an orbiting spacecraft? How do you know? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

